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ORAL IRRIGATION – A TREASURE TROVE IN PERIODONTAL DISEASE MANAGEMENT.

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ABSTRACT:

Periodontal therapy centers around the removal and control of plaque and the restoration of a normal bacterial flora to the periodontal sulcus. To help achieve this goal periodontal pockets have been irrigated, as adjunctive therapy, by a variety of means intended to deliver chemotherapeutic agents to this area and thereby reduce their supragingival and subgingival microflora.Rinsing alone has been found to be an ineffective means of penetrating into periodontal pockets but supragingival irrigation with a syringe and needle using hand pressure was found to partially reach into periodontal pockets.

KEYWORDS:

INTRODUCTION

Also known as hydrotherapy /lavage. The primary purpose of irrigation is to nonspecifically reduce the bacteria and their by-products that lead to the initiation or progression of periodontal diseases. [1]

Objectives [1]–

1. Prevention and treatment of periodontal disease
2. plaque removal and calculus reduction
3. gingivitis ,bleeding on probing and probing depth reductions

- In therapy phase – irrigation with an antimicrobial may be delivered in the office setting by a dental professional.[2] In the maintenance phase , daily home irrigation with water or antimicrobial agent may be added to routine oral hygiene [2]

HISTORY

The first oral irrigator was developed in Fort Collins, Colorado, in 1962, by dentist Gerald Moyer and engineer John Mattingly; this gave rise to the company eventually renamed as Waterpik. Since that time, oral irrigators have been evaluated in more than 50 scientific studies and have been tested (and proven effective) on people in periodontal maintenance, and those with gingivitis, diabetes, orthodontic appliances, crowns, and implants. A 2008 meta-analysis of whether oral irrigation is beneficial as an adjunct to tooth brushing concluded that "the oral irrigator does not have a beneficial effect in reducing visible plaque" but suggests it may be beneficial to gingival health in addition to regular oral hygiene measures.A study at the University of Southern California found that a 3-second treatment of pulsating water (1,200 pulses per minute) at medium pressure (70 psi) removed 99.9% of plaque biofilm from treated areas.[3]

RAM & SLOTS CLASSIFICATION [4]

1. Personally applied (in patient home self-care)

- A. Nonsustained subgingival drug delivery (home oral irrigation)
- B. Sustained subgingival drug delivery (none developed to date)

2. Professionally applied (in dental office)

- A. Nonsustained subgingival drug delivery (professional pocket irrigation)
- B. Sustained subgingival drug delivery

PATIENT APPLIED HOME IRRIGATION

Supragingival irrigation allows for the disruption and dilution of marginal bacteria and their by-products which helps to prevent or treat gingivitis[1] Subgingival irrigation interferes with the complex ecosystem required for the initiation and continued destruction of the compromised periodontium in the susceptible host.[1]

Home (self applied) irrigation - A dentist and his patients - an engineer , developed a home oral irrigator in 1960s. Clinical trials indicated a limited ability to reduce plaque.But there is reduction in gingivitis , BOP and periodontal pathogens often significantly greater than

achieved by brushing and flossing alone.Home irrigation stimulates a host modulation effect , thus helping explain the previous incongruous findings[2]

MECHANISM OF ACTION

Direct application of a pulsed or steady stream water or other solution.Studies by Bhaskar et al[6] and Selting et al[5] , have found pulsation and pressure to be critical components of an irrigation device Pulsating devices are 3 times as effective as continuous – stream irrigating syringes. Pulsation provides for a compression and decompression phase , that may account for expedient clearing of bacteria from the pocket A pulsating device also allows for the control of pressure rate .Majority of studies have been done using an oral irrigator with 1200 pulsations per minute set on medium to high pressure setting – 50-90 psi

A pulsation rate of 1200 per minute creates 2 zones-

impact zone – where the solution initially contacts the area

flushing zone – where solution reaches into subgingival sulcus

Outcome of hydrokinetic activity is subgingival penetration .[2] Home irrigation –penetrate subgingivally with both a standard jet tip and with a soft , site specific , subgingival tip (pik pocket ,waterpik technologies , fort Collins , colo). Supragingival irrigation – irrigation with a standard jet tip – this refers to the placement of jet tip . Point of delivery is at or coronal to gingival margin resulting in penetration of the solution into the subgingival sulcus to approximately 50 %. The standard jet tip is generally used for full mouth irrigation [2]

SUBGINGIVAL IRRIGATION – Irrigation with soft , site specific tip- placement of tip slightly below the gingival margin . Used for localized irrigation of specific site (deep pockets , furcation , implant , crown or bridge .. It can deliver a solution into a pocket of 6 mm or less upto 90 % of its depth . In pockets greater than 6mm , the depth of penetration has been shown to be 64 %[2]

CLINICAL OUTCOME OF HOME IRRIGATION

Removal of plaque and reduction in calculus ,gingivitis , bleeding on probing , probing depth , periodontal pathogens and inflammatory mediators.Home irrigation is applicable for most patients because it has been found to be safe and effective in those with gingivitis , periodontal maintainance patients and in thise with implants , crown and bridge , orthodontic appliances , intermaxillary fixation and diabeties [2]

PROFESSIONAL APPLICATION

Mechanical debridement of deep pockets is often incomplete . Residual subgingival biofilm and calculus often remain in the pocket.Rationale for adding irrigation with antimicrobial agent – if additional bacteria is eliminated from the pocket . 3 factors play an important role in the efficacy of professionally delivered irrigation – penetration, concentration and duration .Using a hand-held syringe or mechanical irrigation using a special pumping device that produces a stream of irrigant with regular intermittent breaks resulting in a pulsating effect. A variety of irrigator tips including cannulas and soft hollow rubber tips have been developed and modified for home or professional use with irrigation delivery systems.

- **PENETRATION –** penetrate base of pocket to reach periodontal infection.To penetrate the pocket , professionally delivered irrigation is accomplished with a blunt cannula using a hand syringe or mechanical device placed 1-3 mm into the pocket. Presence of calculus may impair the subgingival penetration into deep pockets[8]
- **CONCENTRATION-** sufficient to be bacteriocidal or bacteriostatic .50-500 times higher concentrations of antimicrobials are needed to kill bacteria that are embedded in the biofilm compared with planktonic bacteria .The effectiveness of chlorhexidine may be gratly reduced when in contact with blood components in the periodontal pocket [2]
- **DURATION –** maintaining the concentration for sufficient duration to be effective against biofilm DURATION is affected by flushing action of GCF .Greater outward flow of gcf causes solutions that are put to be rapidly washed out .so antimicrobial may not be in contact with the subgingival microflora for sufficient duration to be effective.Half life of solutions delivered subgingivally – 13 minutes. To compensate this, other delivery vehicles that prolong duration have been developed .[2]

PROFESSIONAL APPLICATION WITH PULSED IRRIGATION:

Boyd et al[7] evaluated subgingival irrigation using a pulsed jet irrigator with either a standard tip or a cannula on an oral irrigator and found that irrigation with the cannula tip penetrated farther into both medium (3.5 to 6.0 mm) and deep (≥ 6 mm) pockets than did irrigation with the standard pulsating tip. Larner and Greenstein[8] studied three different irrigator tip designs: a 24 gauge single side-port cannula, monojet subgingival tip (0.955 mm tip with a single end port), and a 23 gauge cannula with a single end port. They determined that the cannula type tip on the oral irrigator had significantly greater penetration than did the monojet subgingival system.

PROFESSIONAL APPLICATION WITH A HAND HELD SYRINGE:

Hardy et al[9] demonstrated clearly that placing an irrigating needle 3 mm within periodontal pockets with a hand-held syringe provides an efficient and predictable means of reaching the apical subgingival plaque border with an irrigating solution. Itac and Serfaty [10]studied the clinical effectiveness of subgingival irrigation with a pulsed jet irrigator versus a syringe and found that professionally administered saline irrigation with a pulsed mono-jet

subgingival irrigate or system to be even more effective than the syringe/needle treatment regardless of the solution used.

CLINICAL OUTCOMES

- A variety of agents with a range of concentrations (chlorhexidine ,tetracycline,stannous fluoride ,povidone iodine) have been used.Regardless of agent used ,either no or minimal improvements over scaling and root planning have been demonstrated .According to study by Quinyren et al[11] – chairside irrigation applications (0.2% chlorhexidine) did not provide better results than scaling and root planning alone . However they did find that those who received chlorhexidine disinfection process had shorter healing times and reported less pain from the procedure

EFFECT ON PLAQUE TOXICITY:

Brownstein et al.[12] suggested that the effect of irrigation on gingival bleeding and to a lesser extent plaque may be due to the following factors:

1) Change in plaque composition;

2) Flushing out of the inflammation-inducing factors;

3) A physical change in tissue integrity.

Others have hypothesized that irrigation may involve specific host-parasite alterations in the subgingival environment or that perhaps the inadvertent mechanical stimulation of the gingiva may in some way be beneficial[13]

SAFETY

Investigators evaluated soft tissues and found no trauma or adverse reaction from using a pulsating oral irrigator. Untreated , chronic periodontial pockets were examined immediately after oral irrigation with pulsating device at medium – high pressure . On SEM analysis, no observable differences between the irrigated and non irrigated specimens in regard to epithelial topography , cavitations , microulcerations etc . According to study by Krajewski et al[14] – he found less inflammation and better connective tissue organization and increased thickness in the keratin layer in individuals who irrigated twice daily compared with those who did not irrigate

IRRIGATING SOLUTIONS

- **WATER:** The majority of studies reviewed utilize some type of a placebo agent as a control including water or saline..It is important to note that the majority of the studies concluded that water provided an equal, and sometime superior, beneficial result when compared to other test medicaments.
- **CHLORHEXIDINE:** Chlorhexidine (CHX) has been shown to possess a broad spectrum of topical antimicrobial activity. It is this property, in addition to the safety, effectiveness, substantivity, lack of serious side effects, and lack of toxicity, that has allowed it to be used extensively in dentistry, usually as a mouthrinse. Chlorhexidine activity in the oral cavity is promoted by binding to plaque, salivary pellicle, oral mucosa, and hard structures and its release for up to 24 hours makes it a highly substantive product.

  Reversible side effects that can occur with prolonged use of chlorhexidine in the oral cavity include staining of hard tissues and some dental materials, altered taste sensation, supragingival calculus accumulations, and less commonly, a mild mucositis.[1]

  2.0% chlorhexidine:

  0.2% chlorhexidine:

  0.12% chlorhexidine

  0.06% chlorhexidine:

  0.04% chlorhexidine:

  0.02% chlorhexidine:

  They tested daily applications of numerous concentrations and volumes of irrigants and concluded that one daily application of 400 ml of a 0.02% chlorhexidine solution was the minimal optimal concentration for complete inhibition of dental plaque.
- **PEROXIDES:** Wennstrom et al. [15]showed that professionally performed periodic subgingival irrigation with hydrogen peroxide used alone, or in combination with thorough mechanical debridement, has a significant therapeutic effect on clinical or microbial parameters. Jones CM et al [16] has shown that 1.5% hydrogen peroxide was of no therapeutic value in the prevention or treatment of an experimental gingivitis when used as a mouth rinse, or in an oral irrigator.There appears to be some advantage in using frequent professional application of hydrogen peroxide in patients infected with Actinobacillus actinomycetemcomitans.
- **FLUORIDES:** Mazza J et al [17] established that subgingival irrigation with 1.64% stannous fluoride (SnF2) was more effective than 0.4% stannous fluoride or saline in decreasing motile bacteria and spirochetes for several weeks in advanced periodontitis patients.
- **IODINE:** Wolff et al.[18] found that a single professional subgingival irrigation with 1.64% stannous fluoride immediately following SRP, when combined with daily home subgingival therapy with a 3.75% iodine solution (3.75mg/ml), was effective in gingivitis and early periodontitis patients. Advantages of iodine alone or in combination with other over-the-counter agents include low cost to the patient and a very low probability of bacterial resistance.

  Since povidone iodine is a topical antiseptic and kills bacteria on contact, rather than effecting cell

wall synthesis and other mechanisms that might adversely alter the ecosystem, opportunistic or resistant organisms are unlikely to develop in response to short-term use of the antimicrobial. Disadvantages include sensitivity (allergy) to iodine which may be rather common, and the potential for staining teeth and restorations with prolonged use. Staining may be avoided by swabbing the teeth with hydrogen peroxide or brushing with a dentifrice immediately after povidone-iodine use.

- **PHENOLICS:** Ciancio SG et al[19] reported that the use of a phenolic mouthrinse in an oral irrigating device could result in significant reductions in plaque, bacterial cell counts, and gingival bleeding, and is an effective adjunct to normal oral hygiene. Fine et al.[20] reported significant short-term microbiological clinical effects of subgingival irrigation with phenolic mouthrinses along with reduction of supragingival plaque and gingivitis.

MICROBIOLOGICALLY MODULATED PERIODONTAL THERAPY OR KEYES TECHNIQUE

The Keyes technique has the two major phases: monitoring and therapy. [1] The therapy phase consists of three components: the local mechanical therapy, the local chemical therapy, and the systemic antibiotic therapy (systemic chemotherapy).

a. The local mechanical therapy: using scaling and root planing plus mechanical oral hygiene effort.

b. The local chemical therapy: achieved preparing a dentrifice consisiting a mixture of baking soda, few drops of water, 3% hydrogen peroxide and Table salt also can be used, or Epsom salt on patient with low sodium diet ..This application of saturated salt solution deep into the sulcus socket spaces will eliminate or reduce potentially periodontopathic bacterial population.

c. The systemic antibiotic therapy: achieved by followed up after mechanical therapy with a course of tetracycline HCl, 250mg q.i.d. for two weeks.

IRRIGATION WITH ANTIBIOTICS

- Root substantivity: Stabholz et al[21] investigated the substantivity and antimicrobial activity of tetracycline-HCl (TCN-HCl) after a single subgingival irrigation prior to tooth extraction. They concluded that 5% tetracycline (50 mg/ml) exhibited significantly greater antimicrobial activity than either 0.12% CHX digluconate for 12 days or saline for 16 days. The 1% tetracycline-HCl (10 mg/ml) exhibited significantly greater antimicrobial activity than 0.12% CHX digluconate and saline for 4 days. Thus, the amount of antimicrobial activity retained is proportional to the concentration of the TCN used for irrigation.
- 10% tetracycline-HCl:
- 0.5% metronidazole:

TOPICAL IRRIGATION WITH NON-STEROIDAL ANTI-INFLAMMATORIES

- Acetylsalicylic acid (ASA): Flemmig et al[22] investigated adjunctive supragingival irrigation with 0.3% acetylsalicylic acid in patients with moderate to severe periodontitis. They concluded that either 0.3% ASA or water irrigation in addition to regular oral hygiene can be a beneficial adjunct to periodontal supportive therapy in patients over a 6-month period. However, the use of buffered 0.3% ASA as an irrigant was not superior to water and does not appear to enhance the clinical efficacy of supragingival irrigation on periodontal health.
- Flurbiprofen, meclofenamic acid, and ibuprofen:. Haesman et al.[23] determined that topically-applied NSAIDS may be of benefit in the management of periodontal inflammation, as the study reported that the systemic absorption of flurbiprofen may have reduced the severity of the developing inflammatory lesions.

  Other Agents -Zinc sulfate, Chloramine-T, Parodontax, Tetrapotassium peroxydiphosphate, Oxygen, Ozone

ULTRASONICS AND ANTIMICROBIALS

Ultrasonic scaling devices have been used to professionally deliver antimicrobial agents into periodontal pockets during mechanical root debridement procedures. Pressurized containers attached to ultrasonic scalers allow an antimicrobial solution to simultaneously act as a coolant for the ultrasonic scaling tip and as a subgingival pocket disinfectant. Commercially available ultrasonic instruments also possess built-in coolant reservoirs designed for these purposes. Thin ultrasonic scaling inserts with similar dimensions as a periodontal probe can reach the base of deep periodontal pockets.

Nosal G et al [24] suggested that an irrigant delivered through ultrasonic scaling tips has shown complete pocket penetration in 86% of sites ranging from 3-9 mm in depth. However, since the irrigant showed only little lateral dispersion from the ultrasonic tip, overlapping working strokes must be employed with the ultrasonic scaling tips to ensure sufficient antimicrobial agent pocket delivery.

BACTEREMIA ASSOCIATED WITH IRRIGATION

- The advisability of recommending oral irrigation for an individual at risk for infective endocarditis. The incidence of bacteremia from oral irrigation ranges from 7 % in patients with gingivitis , upto 50 % in those with periodontitis[1]

Plaque removal and calculus reduction When chlorhexidine was used as an irrigant , statistically significant plaque reductions over routine or traditional oral hygiene .Several investigators found that despite a lack of reduction in plaque index , significant reduction in gingivitis and BOP occurred .

- In 1960s , lobene[25] found that oral irrigation with water added to toothbrushing reduced gingivitis by 52% versus a 30 % reduction infor tooth brushing alone .Barnes et al [26]showed that when a dental water jet was added to either a manual or power tooth brush routine, it was as effective at reducing plaque , bleeding and gingivitis as a manual toothbrush and floss

PERIODONTAL PATHOGENS AND INFLAMMATORY MEDIATORS

Oral irrigation produces both a quantitative and qualitative decrease in periodontal pathogens. Cobb et al[27] observed changes in putative pathogens upto 6mm after irrigation with water at medium-high pressure. Cutler et al[28] demonstrated that over 14 days , daily irrigation with water reduced inflammatory mediators IL-1B,PGE-2, increase in anti inflammatory mediators IL-10, in addition to reducing clinical indices

PATIENTS WITH SPECIAL CONSIDERATIONS

In patients with orthodontic appliances – Hurst and Madonia found that oral irrigation was 80 % more effective in reducing the lactobacillus count than brushing and rinsing in adolescents with orthodontic appliance .For patients with implants, a soft, site specific subgingival tip used with 0.06% chlorhexidine improved oral health better than rinsing .Krajewski et al found that individuals with bridgework or crowns had significant reductions in inflammation from irrigation with water .Phekleps- Sandall and oxford observed that daily oral irrigation in patients with maxillary fixation has less inflammation than those who used either proxy brush or perio- aid [1]

COMPLIANCE-

Flemming et al29 found a 91.5 % compliance rate with oral irrigation .The use of an antimicrobial agent may also effect compliance .When Lainson et al30 followed up with subjects 1 yer after the completion of participation in an oral irrigation study, they found two thirds of the subjects were still using the oral irrigator had significant reductions in gingivitis compared with those who stopped using oral irrigator .The American academy of Periodontology (AAP) position statement on the Role of Supra- and Subgingival Irrigation in the Treatment of Periodontal Diseases(2005) concluded that Supragingival and marginal irrigation does aids in the treatment of gingivitis and maintenance of periodontal patients. Conceptually, irrigation therapy may be of increased value when root planing is less than ideal due to anatomy or other factors. However, it appears that the greatest shortcoming of irrigation therapy is the quick elimination of subgingivally placed drugs. To ameliorate this problem, when appropriate, conventional therapy can be augmented with subgingivally placed adjunctive aids that provide slow release of medicaments.These devices will ensure that a bactericidal dose is maintained for an adequate duration of time to reduce pathogens.[1]

CONCLUSION

Local chemotherapy offers some advantages over systemic applications, however topical agents delivered in an irrigating solutions may fail to affect the periodontal pathogens at the base of the pocket, in furcations, and in other inaccessible areas. In addition, most agents available for home irrigation do not sustain a long term effect due to the rapid decline in the concentration of the agent and the high turnover rate of the sulcular fluid. Local application of solutions by irrigation or mouthrinse depends on “first-order kinetics” (high initial concentrations and multiple applications) in order to provide sustained effectiveness. Modification of the microflora present in the periodontal pocket may be appropriately treated with irrigation or a sustained delivery device, where infection within the tissue will most likely require systemic antibiotics.

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